**What is claimed is:**

1. A solid oxide fuel cell stack comprising:

a plurality of tubular solid oxide fuel cells each comprising concentric inner and outer electrode layers sandwiching a concentric electrolyte layer;

the fuel cells extending in substantially the same direction and arranged in a cluster with at least one fuel cell having an electrolyte layer with a different composition and different maximum operating temperature than another fuel cell in the cluster, the fuel cell having the electrolyte layer with a higher maximum operating temperature being located closer to the core of the cluster than the fuel cell having the electrolyte layer with a lower maximum operating temperature.

2. A solid oxide fuel cell stack comprising

a) an inner tubular solid oxide fuel cell comprising concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a first maximum operating temperature;

b) a middle tubular solid oxide fuel cell inside which the inner fuel cell is located, the middle fuel cell comprising a pair of concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a second maximum operating temperature that is lower than the first maximum operating temperature; and

c) an outer tubular solid oxide fuel cell inside which the inner and middle fuel cells are located, the outer fuel cell comprising a pair of concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a third maximum

operating temperature that is lower than the first maximum operating temperature;

the inner electrode of the inner fuel cell, outer electrode of the middle fuel cell, and the inner electrode of the outer fuel cell being one of an anode and cathode, and the outer electrode of the first inner fuel cell, the inner electrode of the middle fuel cell, and the outer electrode of the outer fuel cell being the other of the anode and cathode.

3. The fuel cell stack of claim 2 wherein inner fuel cell has a $Y_2O_3$-doped $ZrO_2$ electrolyte, the middle fuel cell has a $Sc_2O_3$-doped $ZrO_2$ electrolyte, and the outer fuel cell has a doped-$CeO_2$ based electrolyte.

4. The fuel cell stack of claim 3 wherein the doped-$CeO_2$ based electrolyte is gadolinium cerium oxide.

5. A solid oxide fuel cell stack comprising:

a) a first inner tubular solid oxide fuel cell comprising concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a first maximum operating temperature, and

b) a first outer tubular solid oxide fuel cell inside which the first inner fuel cell is located, the first outer fuel cell comprising a pair of concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a second maximum operating temperature that is lower than the first maximum operating temperature,

the inner electrode of the first inner fuel cell and outer electrode of the first outer fuel cell being one of an anode and cathode, and the outer electrode of the first inner fuel cell and the inner electrode of the first outer fuel cell being the other of the anode and cathode.

6. The fuel cell stack of claim 5 wherein the outer fuel cell has an electrolyte composition selected from the group consisting of doped-$CeO_2$ based and $Sc_2O_3$-doped $ZrO_2$ type electrolytes.

7. The fuel cell stack of claim 6 wherein the doped-$CeO_2$ based electrolyte is gadolinium cerium oxide.

8. The fuel cell stack of claim 5 or 6 wherein the first inner fuel cell has a $Y_2O_3$-doped $ZrO_2$ electrolyte.

9. The fuel cell stack of claim 5 further comprising a second inner tubular solid oxide fuel cell comprising concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, and being located inside the first inner fuel cell, the inner electrode layer of the second inner fuel cell being the same electrode type (anode or cathode) as the outer electrode layer of the first inner fuel cell, and outer electrode layer of the second inner fuel cell being the same electrode type as the inner electrode layer of the first inner fuel cell.

10. The fuel cell stack of claim 7 wherein the electrolyte layer of the second inner fuel cell has the same composition as the electrolyte layer of the first inner fuel cell.

11. The fuel cell stack of claim 8 wherein the first and second inner fuel cells have a $Y_2O_3$-doped $ZrO_2$ electrolyte, and the outer fuel cell has an electrolyte composition selected from the group consisting of doped-$CeO_2$ based and $Sc_2O_3$-doped $ZrO_2$ type electrolytes.

12. The fuel cell stack of claim 11 wherein the doped-$CeO_2$ based electrolyte is gadolinium cerium oxide.

13. The fuel cell stack of claim 5 further comprising a second outer solid oxide fuel cell comprising concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, and being located outside the first outer fuel cell, the inner electrode layer of the second outer fuel cell being the same electrode type (anode or cathode) as the outer electrode layer of the first outer fuel cell, and outer electrode layer of the second outer fuel cell being the same electrode type as the inner electrode layer of the first outer fuel cell.

14. The fuel cell stack of claim 10 wherein the electrolyte layer of the second outer fuel cell has the same composition as the electrolyte layer of the first outer fuel cell.

15. The fuel cell stack of claim 11 wherein the first inner fuel cell has a $Y_2O_3$-doped $ZrO_2$ electrolyte, and the first and second outer fuel cells have an electrolyte composition selected from the group consisting of doped-$CeO_2$ based and $Sc_2O_3$-doped $ZrO_2$ type electrolytes.

16. The fuel cell stack of claim 15 wherein the doped-$CeO_2$ based electrolyte is gadolinium cerium oxide.

17. The fuel cell stack of claim 15 wherein first inner fuel cell has a $Y_2O_3$-doped $ZrO_2$ electrolyte, the first outer fuel cell has an $Sc_2O_3$-doped $ZrO_2$ based electrolyte, and the second outer fuel cell has a doped-$CeO_2$ based electrolyte.

18. A solid oxide fuel cell stack comprising
   a) an electrically conductive support plate; and,
   b) a plurality of tubular solid oxide fuel cell sub-stacks arranged side-by-side on the support plate, each fuel cell sub-stack comprising at least one fuel cell having concentric inner and outer electrode layers sandwiching a concentric electrolyte layer.

19. The fuel cell stack of claim 18 wherein the support plate comprises a porous metal foam matrix sheet.

20. The fuel cell stack of claim 19 wherein the support plate further comprises a metal backing sheet overlaid with and attached to the foam matrix sheet.

21. The fuel cell stack of claim 20 wherein the backing sheet is perforated.

22. The fuel cell stack of claim 18 wherein the fuel cell sub-stack comprises at least two fuel cells wherein two of the fuel cells are

a) a first inner tubular solid oxide fuel cell comprising concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a first maximum operating temperature, and

b) a first outer tubular solid oxide fuel cell inside which the first inner fuel cell is located, the first outer fuel cell comprising a pair of concentric inner and outer electrode layers sandwiching a concentric electrolyte layer, the electrolyte layer having a suitable composition to operate at or below a second maximum operating temperature that is lower than the first maximum operating temperature,

the inner electrode of the first inner fuel cell and outer electrode of the first outer fuel cell being one of an anode and cathode, and the outer electrode of the first inner fuel cell and the inner electrode of the first outer fuel cell being the other of the anode and cathode.

23. The fuel cell stack of claim 18 wherein the support plate is corrugated and each fuel cell sub-stack is located within a corrugation.

24. The fuel cell stack of claim 18 wherein the support plate comprises an electrically conductive metal support layer, and an oxidation-resistant layer coated on the metal support layer.

25. The fuel cell stack of claim 18 or 24 wherein the support layer comprises a metal support layer and a current conducting cathode layer coated on the support layer.

26. A method of manufacturing a solid oxide fuel cell comprising:
   a) arranging a plurality of longitudinally-extending combustible cores side-by-side in a cluster;
   b) using one of electrophoretic deposition, metal electrodeposition and composite electrodeposition to deposit enough inner electrode material onto the cores that the outer periphery of the cluster is covered with electrode material thereby forming a continuous inner electrode layer around the cluster;
   c) depositing electrolyte material onto the inner electrode layer to form an electrolyte layer;
   d) sintering the layers such that the combustible cores combust and at least one reactant channel is formed inside the inner electrode layer; and
   e) applying an outer electrode layer onto the electrolyte layer.

27. The method of claim 26 wherein at least two of the cores are arranged in side-by-side contact, such that after sintering, the two contacting cores combust and a transversely elongated reactant channel is formed.

28. The method of claim 26 wherein at least two of the core are arranged side-by-side in a spaced arrangement, such that inner electrode material is deposited between the spaced cores and after sintering, the two spaced cores combust and two spaced inner reactant channels are formed.

29. The method of claim 27 or 28 wherein the cores are arranged side-by-side in a single row.

30. The method of claim 26 wherein the outer electrode layer is deposited by electophoretic deposition, and before the sintering step.

31. The method of claim 26 wherein after the inner electrode material has been deposited onto the cores and before sintering, the cores are moved closer together until the inner electrode material on one core contacts the inner electrode material on at least one other core.

32. The method of claim 31 wherein after moving the cores closer together and before depositing the electrolyte material, further depositing additional inner electrode material onto the cores.

33. A method of manufacturing a solid oxide fuel cell stack comprising:
  a) arranging a plurality of longitudinally-extending combustible cores side-by-side in a transversely spaced cluster;
  b) forming a plurality of fuel cells by one of electrophoretically depositing, metal electrodepositing and composite electrodepositing inner electrode material onto each core to form an inner electrode layer, then depositing an electrolyte material onto each core to form an electrolyte layer, and applying sufficient outer electrode material onto each electrolyte layer that the outer electrode layer of each fuel cell is physically coupled to an electrode layer of an adjacent fuel cell,
  c) sintering the layers such that the combustible cores combust, thereby forming an inner reactant channel for each fuel cell.

34. The method of claim 33 wherein the sintering step occurs after the electrolyte layer is deposited and before the outer electrode material is applied.

35. The method of claim 34 wherein the outer electrode layer is applied by one of dip-coating and brush-painting.

36. The method of claim 33 wherein the outer electrode material is applied onto the electrolyte layers by electrophoretic deposition, and the sintering step occurs after the outer electrode material is applied.

37. The method of claim 33 wherein after the inner electrode material and electrolyte material has been deposited, the cores are moved closer together before the outer electrode material is applied onto the electrolyte layers.